

THE LICKING RIVER BASIN

This report is in three parts. The first is a general basin description, the second describes the water quality, and the third part summarizes the problems and offers some general solutions.

I. A Description of the Licking River Basin

A. Geography

The Licking River Basin is located entirely within the eastern portion of the Commonwealth of Kentucky. The Licking River rises in southeastern Kentucky and flows northwesterly to its confluence with the Ohio River, opposite Cincinnati, Ohio. The total drainage area of the basin is 3,700 sq. mi. which is approximately 9 per cent of the land area of the state and includes all or portions of 21 counties. The basin is shaped much like an elongated diamond with an axis of about 130 miles and a minor axis of about 60 miles. The main stem is approximately 320 miles long.

The basin extends from Covington and Newport, Kentucky in the north, to below Salyersville in the south and from beyond Flemingsburg and Morehead in the east to Winchester in the west.

B. Topography

The Licking River drainage area is entirely south of the glaciated portion of the Ohio River Basin and physical features of the basin are generally the result of geological strata exposed by differential erosion following the broad uplift of the Paleozoic Era known as the Cincinnati Arch. The Licking River Basin exhibits four distinct physiographic types. The river rises in the Eastern Coal Fields of the Kanawha section of the (1) Appalachian Plateau, which has narrow ridges and crooked steep sided valleys. It flows through the (2) Knobs and the (3) Outer Blue Grass Regions. The South Fork

drains a portion of the (4) Inner Blue Grass region of the Interior Low Plateau. The Knobs is an area of conical hills with rather broad valleys. The Outer Blue Grass is rather gently rolling except where the streams have entrenched themselves into deep valleys. The Inner Blue Grass region is gently rolling upland. There are no natural lakes in the basin. The generally flat topography of the Licking River Basin allows little reaeration due to the slope of the streams. Reaeration is the replacement of dissolved oxygen from the atmosphere which is used to stabilize organic matter. The river courses from an elevation of 998 ft. mean sea level (m.s.l.) at its headwaters to an elevation of 420 ft. m.s.l. at the confluence with the Ohio River for some 320 miles. The main stem has an average slope of approximately 1.9 ft./mi. Over the low half of the river the average slope is 1.3 ft./mi. The slopes of the tributaries average between 1 to 2 ft./mi. for the North and South Forks and into the hundreds of feet per mile in some of the smaller tributaries. A slope in the range of 0 to 2 ft./mi. is considered low, 2 to 6 ft./mi. is moderate and 6 to 10 ft./mi. is high as it relates to the effect of reaeration.

C. Geology

The major geologic influence on the quality of the water in the Licking River Basin is the occurrence of limestone throughout the basin. Limestone contributes calcium and magnesium through solution from the soil and rocks which imparts hardness to the water. The coal field does not appear to be having a significant effect on water quality at this time.

The groundwater resources are limited by the low yield of the aquifers in the basin, thus restricting the use of groundwater as a major source of water supply.

D. Hydrology

During the late summer and early autumn, portions of the Licking River have flows of less than 5 cubic feet per second (Table I-2). Such low flows severely limit the capacity of a stream to maintain the standard of 5 mg/l of dissolved oxygen. Cave Run Reservoir near Farmers, Kentucky, 174 miles from the mouth, was built to store 47,000 acre feet of water for flood control, water supply recreation and low flow augmentation. Cave Run Reservoir is designed to augment the low flow in the Licking River by 50 cubic feet per second (c.f.s.).

E. Population

The population of the Licking River Basin was 211,000 in 1970. The distribution throughout the basin is fairly uniform except for a major population center in Campbell and Kenton Counties, composing a part of the SMSA of Cincinnati, Ohio. Although Campbell and Kenton Counties don't discharge treated sewage into the Licking River, combined sewer overflow and street run-off do affect water quality in the lower Licking River. The total urban population of the basin is 106,000 or 50 per cent of the whole basin. The other 50 per cent is in rural areas.

TABLE I-2

SURFACE WATER RECORDS FOR THE LICKING RIVER BASIN

STATION	PERIOD OF RECORD	DRAINAGE AREA	AVERAGE FLOW		MAXIMUM FLOW		MINIMUM FLOW		7-day/10-yr. LOW FLOW
Licking River at Farmers **	37 yr.	827 sq.mi.	1,073 cfs,	$\frac{1.3\text{cfs}}{\text{sq.mi.}}$ *	24,000 cfs,	$\frac{29\text{cfs}}{\text{sq.mi.}}$	0.7 cfs,	$\frac{0.0\text{cfs}}{\text{sq.mi.}}$	54.4 cfs
	wtr/yr 1975		1,556 cfs,	$\frac{1.9\text{cfs}}{\text{sq.mi.}}$	4,020 cfs,	$\frac{5\text{cfs}}{\text{sq.mi.}}$	66 cfs,	$\frac{0.1\text{cfs}}{\text{sq.mi.}}$	
I-4 South Fork Licking River at Cynthiana	37 yr.	621 sq.mi.	763 cfs,	$\frac{1.2\text{cfs}}{\text{sq.mi.}}$	35,300 cfs,	$\frac{57\text{cfs}}{\text{sq.mi.}}$	0.3 cfs,	$\frac{0.0\text{cfs}}{\text{sq.mi.}}$	0.9 cfs
	wtr/yr 1975		1,087 cfs,	$\frac{1.8\text{cfs}}{\text{sq.mi.}}$	18,000 cfs,	$\frac{29\text{cfs}}{\text{sq.mi.}}$	5.7 cfs,	$\frac{0.0\text{cfs}}{\text{sq.mi.}}$	
Licking River at Catawba **	49 yr.	3,300 sq.mi.	4,156 cfs,	$\frac{1.3\text{cfs}}{\text{sq.mi.}}$	95,000 cfs,	$\frac{29\text{cfs}}{\text{sq.mi.}}$	2.5 cfs,	$\frac{0.0\text{cfs}}{\text{sq.mi.}}$	62 cfs
	wtr/yr 1975		5,938 cfs,	$\frac{1.8\text{cfs}}{\text{sq.mi.}}$	52,100 cfs,	$\frac{16\text{cfs}}{\text{sq.mi.}}$	203 cfs,	$\frac{0.1\text{cfs}}{\text{sq.mi.}}$	

* Cubic feet per second

** Flow regulated since December, 1973 by Cave Run Lake.

NOTE: Data is taken from "Surface Water Records in Kentucky" by the United States Geological Survey. The 7-day/10-yr. low flow was taken from the waste load allocation produced as a component of the 303e River Basin Continuing Planning Process.

II. Basin Water Quality

The water quality of the Licking River Basin has been determined by using both a computer model and data collected at three monitoring stations. These sources give an overall picture of the basin which shows problems caused by sewage treatment plant effluent and erosion.

A. Description of Sampling Stations

The Salyersville monitoring station, the farthest upstream of the three stations, is on the Licking River 1.2 miles west of Salyersville and 266 miles from the mouth. The drainage area at this point is 140 sq. mi.

The second station, at McKinneysburg, on the Licking River is 64 miles from the mouth and has a drainage area of 2,300 sq. mi.

The last station is at the Kenton County water intake on the Licking River approximately 2 miles from the mouth at the Ohio River. The drainage area at this station is approximately 3,700 sq. mi.

B. General Chemical Water Quality

The chemical composition of water is best defined by grouping dissolved elements which compose the total dissolved solids. By examining the relationships of groups of chemicals, the type of water whether hard or soft, salty, acid or high in sulfates reflects the mix of surface and groundwater. The chemical characteristics of a stream when viewed over a long period of time is primarily from surface water. The type of rock formation and soils which the surface water contacts causes this predominate chemical characteristic. The contribution of groundwater, which is generally higher in dissolved solids than surface water, can be shown by selecting the low flow period for data analyses. The general character of waters in Kentucky is of moderate hardness caused by calcium and magnesium salts. The influence of mining activities are clearly indicated when the sulfate content increases to a higher level than the bicarbonate content, and the pH is on the acid side, below pH 5.5.

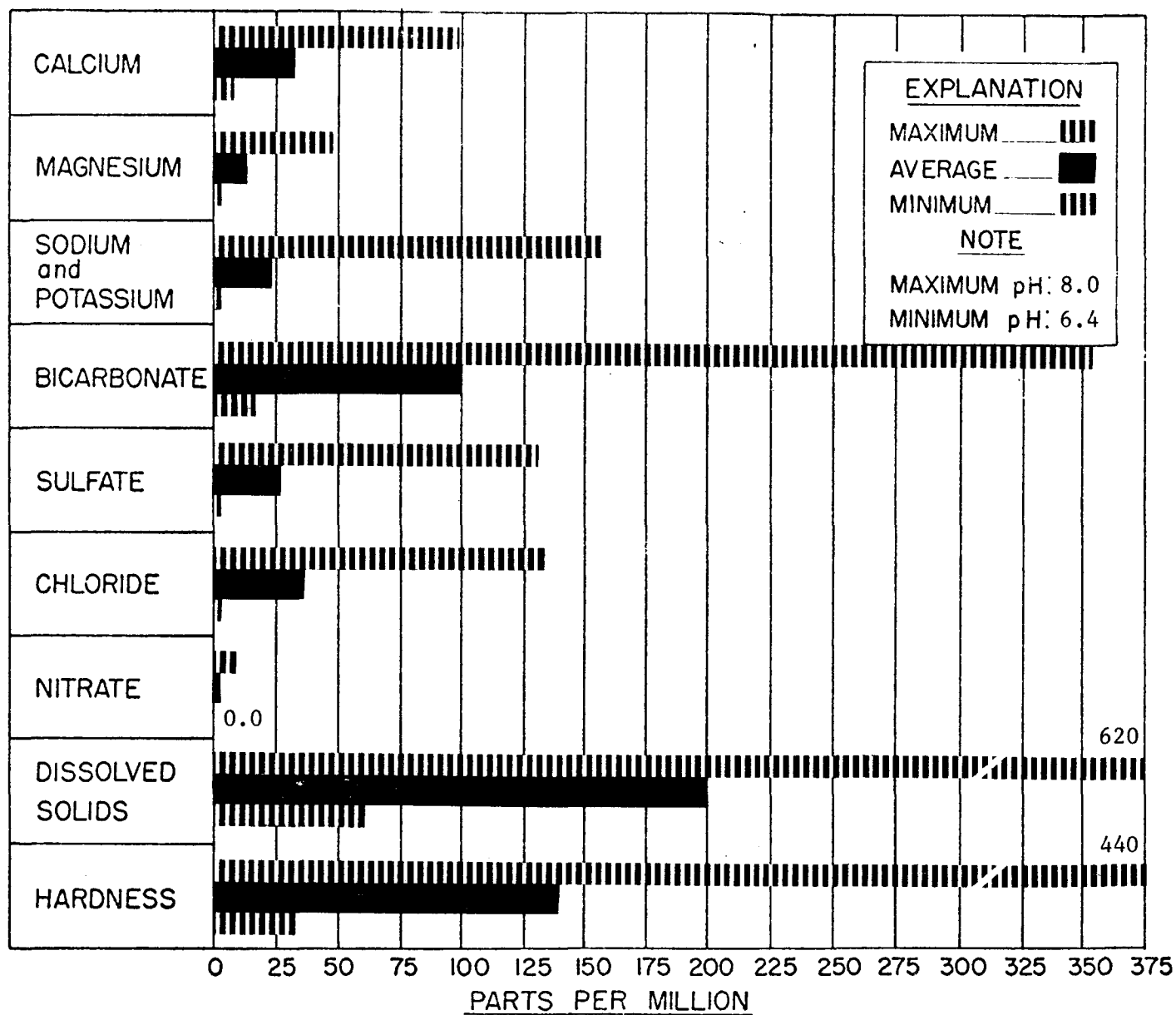


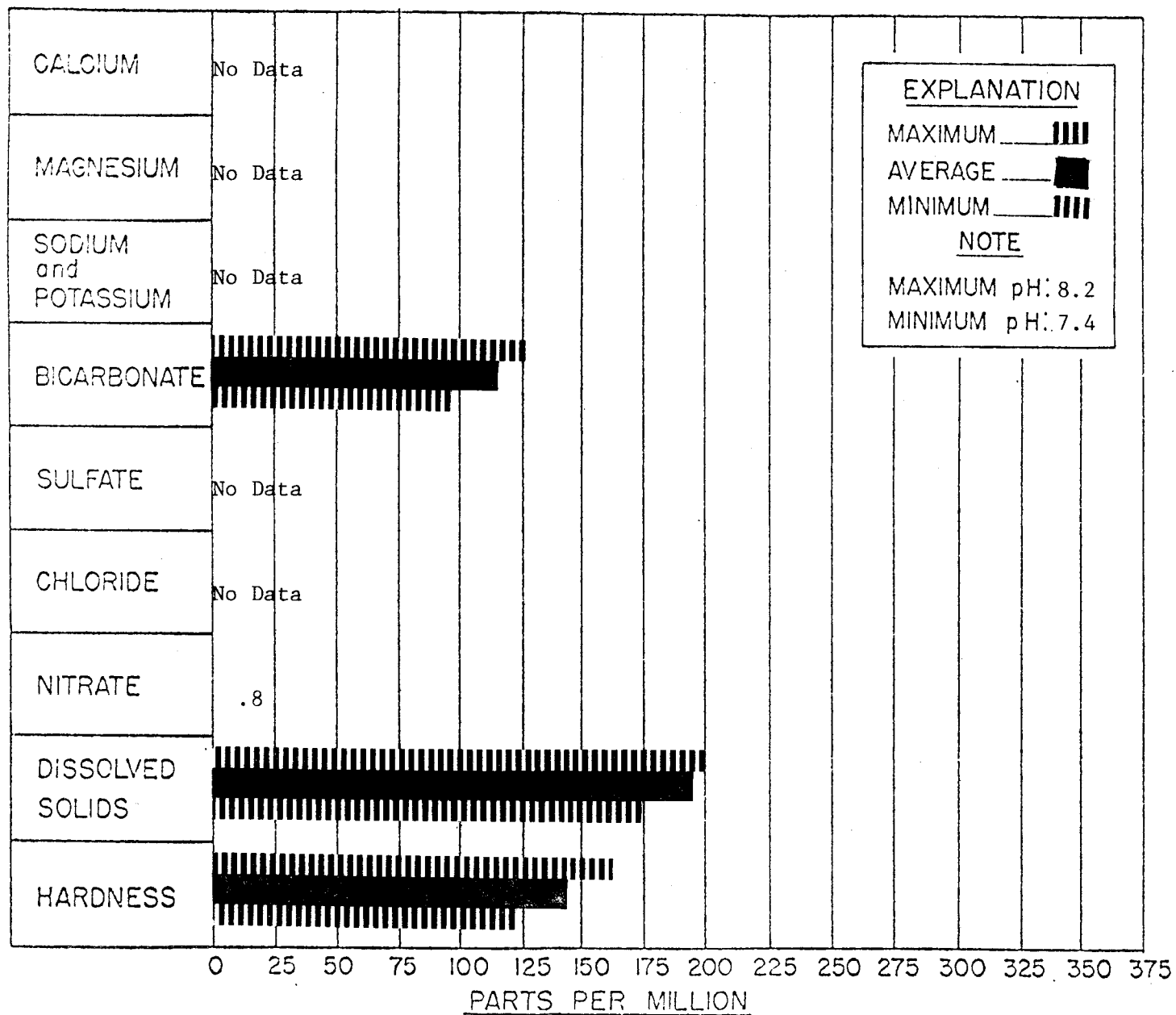
FIGURE I-1

Licking River

Salyersville

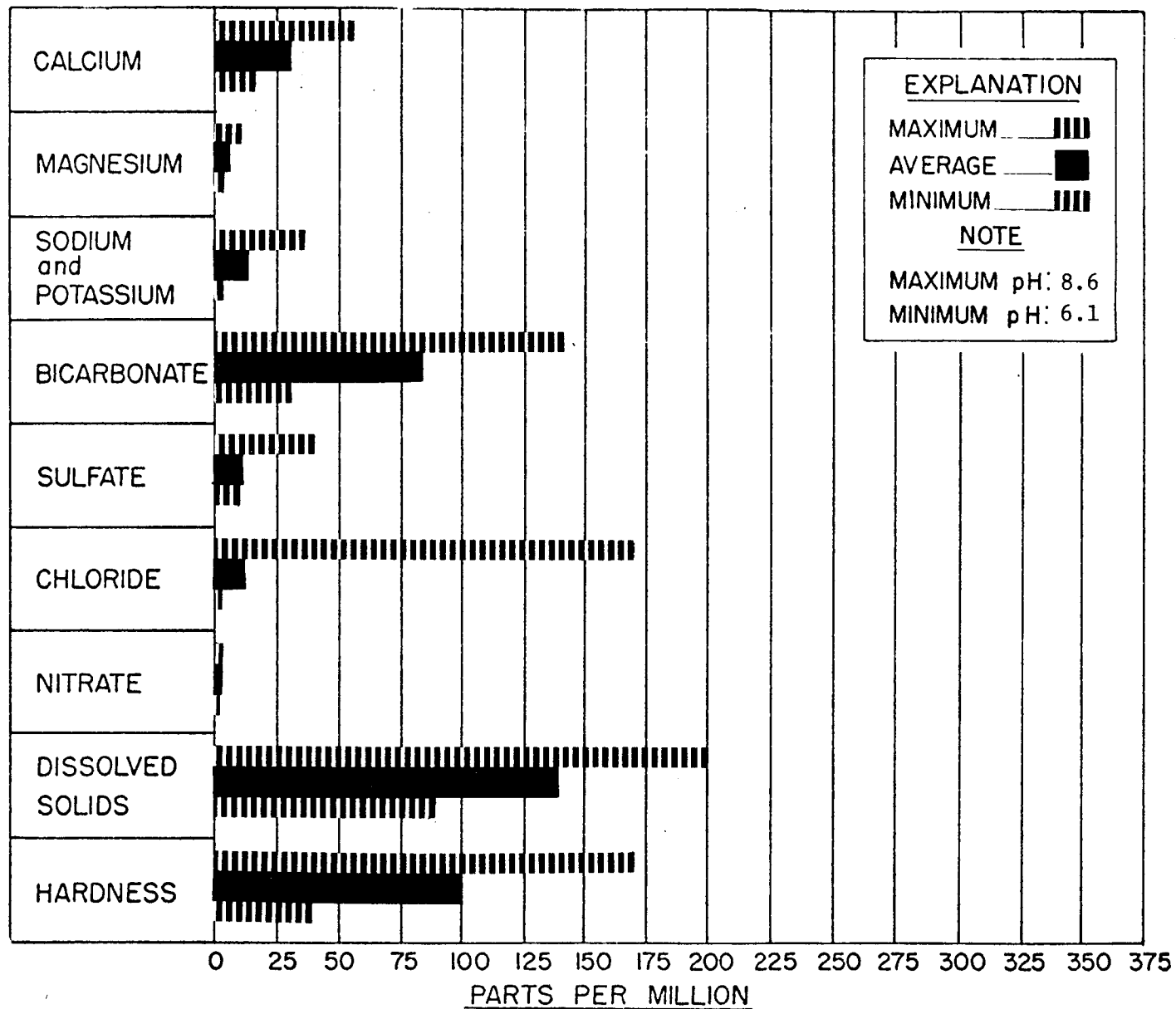
5-65 to 11-74

MAXIMUM, AVERAGE, and MINIMUM concentrations of dissolved constituents,



MAXIMUM, AVERAGE, and MINIMUM concentrations of dissolved constituents

FIGURE I-2
North Fork Licking River
9-70 to 8-72



MAXIMUM, AVERAGE, and MINIMUM concentrations of dissolved constituents,

FIGURE I-3
Licking River
McKinneysburg
10-59 to 10-73

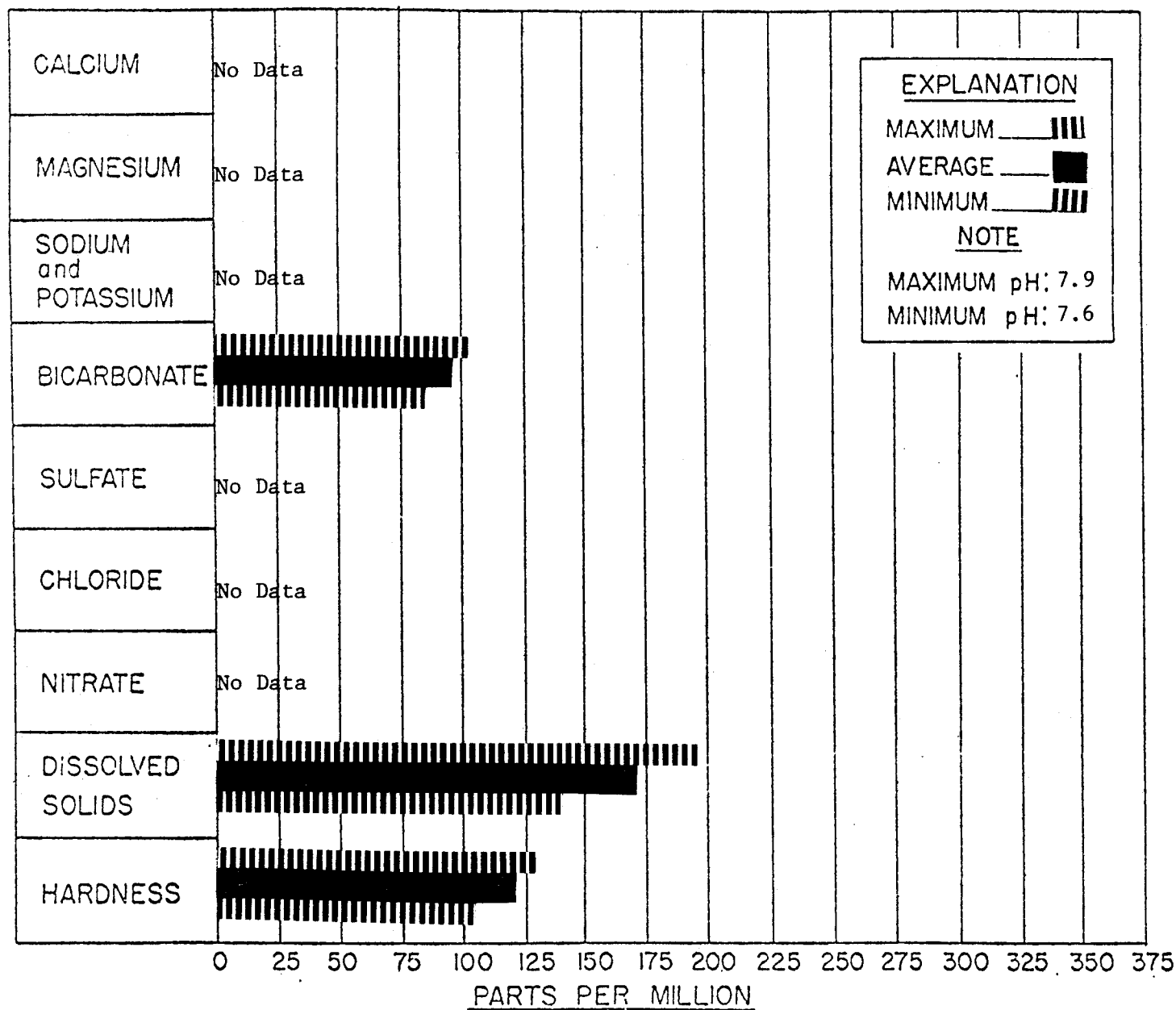
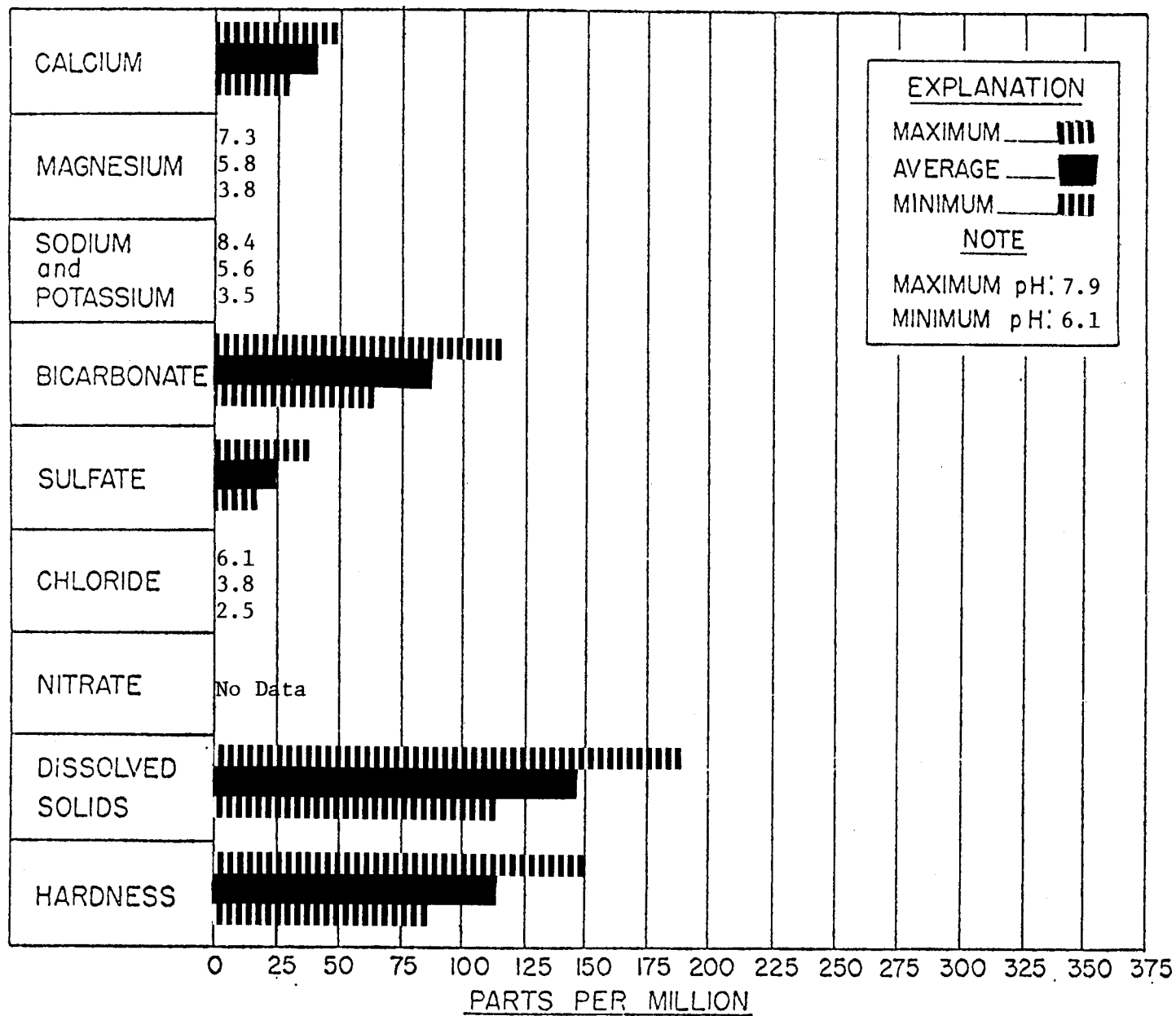


FIGURE I-4
 Licking River
 Catawba
 1962 to 1974

MAXIMUM, AVERAGE, and MINIMUM concentrations of dissolved constituents



MAXIMUM, AVERAGE, and MINIMUM concentrations of dissolved constituents

FIGURE I-5

Licking River

Butler

10-74 to 12-75

Oil field operations, when brine is encountered, are reflected by changes in sodium and chloride contents of the water. For Kentucky water, the influence is pronounced when either chloride or sodium exceeds 20-25 parts per million as an average value.

Two sampling stations which were used to depict the general chemical water quality for the Licking River basin reflect two different situations on the river.

Salyersville was selected to determine the effect of coal mining on water quality. This station is near the headwaters and above Cave Run Reservoir, and shows a wide variation in chemical quality partly due to the relatively small drainage area. That area is totally within the eastern coal field and fluctuations at the Salyersville station indicate the effects of coal mining and oil field operations on water quality. The effect of coal mining and oil field productions is illustrated principally in Figure I-1. The extreme variation in all parameters in comparing the average to the maximum indicates the influence of sporadic discharges which impacts water quality primarily at low flow periods. The production of coal in the Licking River Basin is low as compared to the Coal reserves. Oil field production is primarily limited to recharge well production which is limited. Both of these developments reflect the primary influence of water quality, particularly at times of low flow, since the average values are much as would be expected without oil or coal production. Figure I-4 indicates that the water is typical of Kentucky stream water when looking at the average values.

McKinneysburg, another station, was selected to indicate general chemical water quality of the majority of the drainage basin (62%) and the effects of Cave Run Reservoir as compared with the Salyersville station.

The water is classified as soft, moderately hard, hard, and very hard due to the concentration of certain ions. primarily calcium and magnesium. The range of hardness is 121 mg/l + 180 mg/l with an average of 136 which is hard water.

The impact on water quality from Cave Run Reservoir at McKinneysburg is clearly illustrated by comparing the graphs of McKinneysburg and Salyersville. All parameters decrease at McKinneysburg which demonstrates the effectiveness of water reservoir impoundments for quality control of the general chemical quality of water and the ability of a reservoir to iron out or stabilize imparted chemical quality from the exploration of mineral resources such as coal and iron field developments.

C. Trace Chemical Water Quality

Trace elements (under 5 mg/l) are separated from the general chemical background of this report because of their influence on human health. Generally, these materials are "heavy" metals, which in sufficient concentrations have a toxic or otherwise adverse effect on human and animal or plant life. Levels for many of these elements have been established for years in the Drinking Water Standards and more recently through the State-Federal Water Quality Standards.

The trace chemicals results were from samplings at the Kenton County water district and in the Licking River Basin the water quality falls within the Kentucky-Federal Water Quality Standards.

D. Waste Load Effects on Water Quality

Biochemical degradable wastes impose a load on the dissolved oxygen resources of a stream. Such waste loads are considered to have an adverse effect on water quality when they cause the dissolved oxygen concentration of the water to drop below the Kentucky water quality standard of 5.0 mg/l. Approximately 1,000 miles of stream length were studied using a model to determine waste load allocations. The model was developed in the Kentucky Continuing Planning process for River Basin Management Planning. Using this model it was determined that approximately 384 miles are affected by treated wastewater. Of the 384 miles 46 miles are affected by industry, 89 miles by municipal sewage treatment plants and 249 miles are affected by other sources such as schools, trailer parks, motels, etc.

E. Non-Point Source Effects

Major non-point source pollution problems in the Licking River Basin include sediment from agricultural erosion, field gullies, streambank erosion, roadbank erosion, and erosion from soil disturbances during development of areas for commercial, residential, and industrial purposes. The following estimates were obtained from Soil Conservation Survey of U. S. Department of Agriculture.

Erosion from about 78 sq. mi. of cropland contributes an estimated 57% of the total annual sedimentation entering the stream system.

It is estimated that over 24% of the sediment entering the Licking River annually is a result of erosion from construction sites. The source is concentrated in the lower section of the basin.

Approximately 5.5 sq. mi. of field gullies have a potential for producing 10% of the annual sedimentation.

Streambank erosion is severe on about 400 miles in the basin, with a potential for producing over 7% of the sediment annually.

Approximately 170 miles of critical roadbank erosion have the potential for producing 2% of the sediment annually.

F. Water Uses

The major use of water in the Licking River Basin is industrial. An estimated 18 million gallons per day (m.g.d.) are used by industries while 9 m.g.d. are used for public consumption. Kenton County Water District #1 withdraws approximately 50% of the total public withdrawal and Interlake Steel Corporation withdraws approximately 80% of the industrial total. A complete breakdown can be found in Table I-6.

The Licking River is a well known Kentucky fishing stream. Throughout much of the basin high quality fish can be taken including "muskie" and bass. Cave Run Reservoir offers even more opportunity for recreational activities, and the area is now being developed to include more boating and swimming facilities.

The primary use of water in the basin for agriculture is livestock watering. The water quality doesn't limit the use for other agricultural practices but rather the usually abundant rainfall provides a more than adequate amount of water without supplementation from streams.

III Summary

The water quality as indicated by the Salyersville, McKinneysburg and Kenton County gauging stations appears to be good. Salyersville is particularly good even though it is in a mining area and McKinneysburg is even better due to the larger drainage area and the buffering action of Cave Run Reservoir.

The two problem areas that presently need the most attention in the Licking River Basin are erosion with subsequent siltation, and possible stream degradation due to sewage treatment plant effluent.

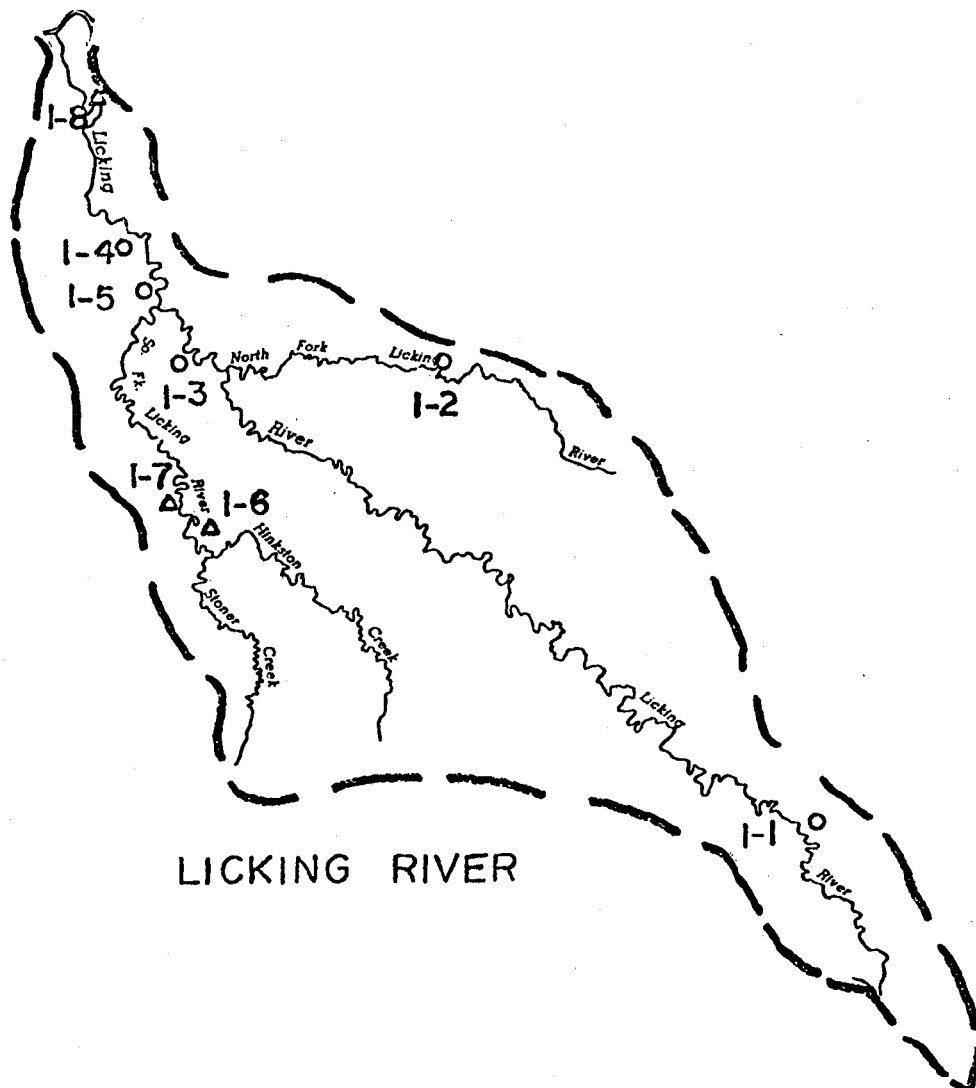
Both problems lend themselves to easy statements for solutions; such as better land use management for control of erosion and upgrading sewage treatment facilities for both the private and public sectors.

The majority of the siltation comes from cultivated fields. Much of the Licking River Basin is in an agricultural area and the implementing of farming practices to prevent soil erosion is needed. The real possibility of a threefold increase in coal mining in Kentucky also raises the prospect of increased siltation and acid mine drainage. The coal fields in the Licking River Basin are relatively undeveloped and the trend to increased coal mining can pose a serious threat to the basin's water quality. Present and possible future federal and state legislation controlling mining practices will be needed if the integrity of water quality is to be maintained.

The sewage treatment plant effluent problem is very complex. Upgrading of existing facilities is underway in both the construction and planning phases. Numerous small "package" treatment plants still dot the countryside. The effluent from these plants is often of inadequate quality to protect the receiving stream. This large number and relatively small size make operation and enforcement difficult. Either an improvement in the design of "package"

treatment plants or running sewers from these outlying areas to central sewage treatment plants is needed to protect the small tributaries.

Neither of the above mentioned problems are peculiar to the Licking River Basin in Kentucky. Their solution will most likely be a part of the statewide implementation of the 303e River Basin Planning Process and other related programs.



GRAPHIC SCALE IN MILES

Base Data: U. S. Geological Survey

STATION KEY

- I-1 LICKING RIVER AT SALYERSVILLE
- I-2 NORTH FORK LICKING RIVER
- I-3 LICKING RIVER AT MCKINNEYSBURG
- I-4 LICKING RIVER AT BUTLER
- I-5 LICKING RIVER AT CATAWBA
- I-6 LICKING RIVER AT PARIS
- I-7 LICKING RIVER AT CYTHIANA
- I-8 LICKING RIVER AT KENTON Co. WATER PLANT INTAKE

Table I-1

Drainage Areas in the Licking River Basin

* a. Total Area in Square Miles				3707	
b. Sub-basins over 200 square miles					
Licking River Basin				3707	sq. mi.
1. North Fork Licking				308	sq. mi.
2. Slate Creek				230	sq. mi.
3. South Fork Licking				927	sq. mi.
a. Stoner Creek				284	sq. mi.
b. Hinkston Creek				260	sq. mi.
c. Area of Basin in each County**				Total	Sq. Mi.***
				Sq. Mi.	in basin
1.	Bath	100	%	287	287
2.	Boone	1.9	%	249	7
3.	Bourbon	100	%	300	300
4.	Bracken	44	%	204	90
5.	Campbell	44	%	149	65
6.	Clark	37	%	259	95
7.	Elliott	4	%	240	9
8.	Fleming	100	%	350	350
9.	Grant	36	%	249	91
10.	Harrison	100	%	308	308
11.	Kenton	86	%	165	143
12.	Lewis	8	%	486	39
13.	Magoffin	96	%	303	290
14.	Mason	62	%	238	147
15.	Menifee	62	%	210	131
16.	Montgomery	88	%	204	180
17.	Morgan	90	%	369	332
18.	Nicholas	100	%	204	204
19.	Pendleton	91	%	279	255
20.	Robertson	100	%	101	101
21.	Rowan	94	%	290	273

* Drainage Areas in Kentucky, Frankfort, Kentucky, December 20, 1974

** Area - U. S. Census - Source of measurement - Approximately \pm 10%

*** Percent in Basin - Federal Water Pollution Control Administration - Ohio River Basin Framework Comprehensive Study

Table I - 3
City Population and Facility Grant Status
in the Licking River Basin in Kentucky

County	City	Population	Project Type	Comments
Bath	Owingsville	1,381	I	Underway
	Salt Lick	441	I	Pending
Bourbon	Paris	7,823	I	Underway
	Millersburg	788	I	Underway
	North Middletown	433	None	Sewered
Campbell	San. Dist. #2		None	Sewered
Clark	Winchester	13,402	I & III	Underway
Fleming	Flemingsburg	2,483	I	Underway
Grant	Williamstown	2,063	I	Underway
	Crittenden	359	None	No Sewers
	Corinth	236	None	No Sewers
Harrison	Cynthiana	6,356	I	Underway
	Berry	266	None	No Sewers
Kenton	Elsmere	5,161	None	Sewered
	Independence	1,784	None	No Sewers
Magoffin	Salyersville	1,196	I	Pending
Menifee	Frenchburg		None	Sewered
Montgomery	Mt. Sterling	5,083	I	Underway
			II	Pending

Table I - 3
Continued

Montgomery (con't)	San. Dist. #1 San. Dist. #2		III I	Underway Underway
Morgan	West Liberty	1,387	None	Sewers
Nicholas	Carlisle	1,579	I	Underway
Pendleton	Falmouth Butler	2,593 558	I None	Underway Sewered
Robertson	Mt. Olivet	442	None	No Sewers
Rowan	Morehead	7,191	I II	Underway Pending

Note: Project type is related to the type of grant applied for received by each city. Type I is for preliminary studies necessary before design of the facility. Type II is the design phase of a facility and Type III is for the construction of a facility for the collection and treatment of domestic sewage.

The comments relate to the status of the grant. Underway indicates the project is funded. Pending indicates that application for a grant has been made and is pending approval and no sewers means when a grant is requested that it is for a complete and original system.

The source of this information was the 1970 U. S. Census and the FY 75 construction grants list for Kentucky.

TABLE I-4

Population in the Licking River Basin by County

COUNTY	TOTAL POP. 1970	POP. IN BASIN
Bath	9,114	9,114
Boone	21,940	150
Bourbon	18,178	18,178
Bracken	7,422	2,400
Campbell	86,803	9,500
Clark	21,075	16,000
Elliott	6,330	200
Fleming	10,890	10,890
Grant	9,489	5,000
Harrison	13,704	13,704
Kenton	120,700	49,000
Lewis	13,115	900
Magoffin	11,156	10,000
Mason	18,454	7,000
Menifee	4,276	2,800
Montgomery	13,461	13,000
Morgan	11,056	9,100
Nicholas	6,677	6,677
Pendleton	9,949	9,400
Robertson	2,163	2,163
Rowan	17,010	16,000
		<hr/> 211,176

Table I-5

Organic Loads Affecting Streams in the Licking River Basin

Length of streams to which treated organic loads are discharged	1,000
Stream length for which dissolved oxygen is predicted to be below 5 mg/l during periods of low flow	384
Stream length for which dissolved oxygen is predicted to be below 5 mg/l during periods of low flow due to	
Municipal Discharges	89
Industrial Discharges	46
Other Discharges	249

NOTE: This information is from the waste load allocation for Kentucky and is an output from the 303e river basin planning effort. The values indicated the stream miles in which the dissolved oxygen is predicted to be less than 5 mg/l when the stream flow is less than the once in ten year, seven day, low flow.

TABLE I-6

WATER WITHDRAWAL IN THE LICKING RIVER BASIN

COUNTY	CREEK	SW *	GW **	PUBLIC	INDUSTRIAL
BATH					
Municipal Water & Sewer Service	Slate Creek	x		.150 MGD ***	
Sharpsburg Water District	Reservoir	x		.032 MGD	.003 MGD
BOONE					
Municipal Water Works					
Walton	Two Lakes	x		.098 MGD	
BOURBON					
Paris Municipal Water Works	Stoner Creek		x	.575 MGD	.530 MGD
Millersburg Municipal Water Works	Hinkston Creek	x		.105 MGD	.005 MGD
N. Middletown Municipal Water Works	Stoner Creek	x		.046 MGD	
CAMPBELL					
Interlake Steel Corporation	Licking River	x			14.9 MGD
FLEMING					
Flemingsburg Municipal Water Works	2 reservoirs	x		.107 MGD	.088 MGD
Western Fleming Water District, Ewing	Licking River	x		.206 MGD	.004 MGD
GRANT					
Williamstown Municipal Water Works	Lake Branch Res.	x		.173 MGD	.051 MGD
Corinth, Wm. O. Ratcliff	Reservoir	x		.013	
HARRISON					
Cynthiana Municipal Water Works	S. Fork of Licking River	x		.773	.515
Cynthiana, Joseph E. Seagram and Sons	S. Fk. Licking River & Well	x	x		.010 GW 1.250 SW

Continued - I-6

COUNTY	CREEK	SW	GW	PUBLIC	INDUSTRIAL
KENTON					
Kenton Co. Water Dist. #1	Licking River	x		4.663	.047
S. Fort Mitchell					
MONTGOMERY					
Mt. Sterling Municipal					
Water Works	Slate Creek Res.	x		.235	.941
MORGAN					
West Liberty Municipal					
Water Works	Licking River	x		.175	
NICHOLAS					
Carlisle Municipal					
Water Works	Two Lakes	x		.230	.012
PENDLETON					
Falmouth Municipal					
Water Works	Licking River	x		.310	.020
Mago Construction Co. Inc.	Licking River	x			.001
Bardstown					
Butler Municipal Water					
Works	Licking River	x		.086	
ROBERTSON					
Mt. Olivet Municipal					
Water Works	Licking River	x		.030	
POWELL					
Morehead State University	Evans Br. Res.	x		.548	.029
	S. Fk. Triplett Cr.				
Morehead Utility Plant					
Board	Licking River	x		.412	.008
Tennessee Gas Pipeline Co.	N. F. Triplett	x			.010
Morehead	Creek				
Morehead	Impoundment on	x			.001
	Schoolhouse Br.				

SW - Surface Water

GW - Ground Water

MGD - Million Gallons per Day

TOTAL

8.967

18.413

Table I-7

Water Quality Data in the Licking River Basin

Station	Beg. Date	End Date	Mean	Max.	Min.	OBS.	S
STORET #00400 pH Specific Units Kentucky Standard 1-LT pH-9							
Licking River	70/07/29	74/10/02	6.9	7.3	6.4	37	.214
Salyersville	65/05/19	74/10/02	6.9	7.3	6.4	38	.212
U.S.G.S. #03248500							
N. Fork Licking River LE	70/09/23	72/08/15	7.8	8.2	7.4	3	.400
U.S.G.S. #03251000							
Licking River	70/01/13	73/09/25	7.7	8.4	6.9	94	.342
McKinneysburg	65/01/13	73/09/25	7.6	8.6	6.6	212	.371
U.S.G.S. #03251500	59/11/03	73/09/25	7.6	8.4	6.1	268	.396
Licking River	75/01/08	75/12/03	7.1	7.9	6.1	12	.506
Butler	74/10/17	74/11/21	7.7	7.9	7.4	2	.354
U.S.G.S. #03254000							
Licking River	70/09/23	72/08/15	7.9	7.9	7.9	3	.008
Catawba	62/09/24	72/08/15	7.8	7.9	7.6	4	.150
U.S.G.S. #03253500							
STORET #00095 Conductivity Micro mhos, Ky. Std. 800 micro mhos							
Licking River	75/01/02	76/01/17	184.5	290.9	100.0	10	75.6
Salyersville	70/07/29	74/11/19	279.7	1170	102.0	44	201.2
	65/05/19	76/01/17	263.2	1170	100.0	55	186.1
N. Fork Licking River LE	70/09/23	72/08/15	287.0	315.0	250.0	3	33.4
Licking River	70/01/03	73/09/25	232.3	801.0	103.0	94	87.1
McKinneysburg	65/01/13	73/09/25	237.8	801.0	103.0	223	78.4
	59/10/07	73/09/25	238.4	801.0	102.0	368	76.6
Licking River	75/01/08	75/12/03	242.5	338.0	175.0	11	53.5
Butler	74/10/17	74/12/10	258.7	301.0	220.0	3	40.6
Licking River	70/09/23	74/08/23	235.3	264.0	212.0	6	22.8
Catawba	62/09/24	74/08/23	242.6	286.0	212.0	7	28.3

Table I-7
Continued

Station	Beg. Date	End Date	Mean	Max.	Min.	OBS.	S
STORET #70300	Dissolved Solids mg/l, Kentucky Standard 500 mg/l						
Licking River	75/01/02	75/12/04	106.9	175.0	50.0	9	44.8
Salyersville	70/97/29	74/11/19	166.8	722.0	65.0	44	120.7
N. Fork Licking River LE	70/09/23	72/08/15	190.0	200.0	174.0	3	14.0
Licking River	70/01/03	75/10/09	142.7	490.0	64.0	94	53.6
McKinneysburg	65/01/13	73/09/25	148.2	490.0	62.0	223	48.1
	53/10/26	73/09/25	143.7	490.0	62.0	423	42.6
Licking River	75/01/08	75/10/09	137.7	182.0	113.0	10	21.0
Butler	74/10/17	74/12/10	159.3	180.0	140.0	3	20.0
Licking River Catawba	70/09/23	72/08/15	177.7	194.0	138.0	3	30.3
STORET #00410	Alkalinity mg/l, No Standard						
Licking River	75/01/02	75/12/04	38.4	86.0	13.0	9	25.8
Salyersville	70/07/29	75/12/04	37.6	84.0	16.0	44	19.3
N. Fork Licking River LE	70/09/23	72/08/15	116.3	126.0	98.0	3	15.9
Licking River	70/01/03	73/09/25	79.7	141.0	31.0	94	27.5
McKinneysburg	65/10/07	73/09/25	82.0	141.0	31.0	171	26.3
Licking River	75/01/03	75/10/09	82.9	104.0	63.0	10	12.6
Butler	74/10/17	74/12/10	99.0	118.0	80.0	3	19.0
Licking River Catawba	62/09/24	72/08/15	95.8	103.0	82.0	4	9.9
STORET # 00900	Hardness mg/l, 0-6- Soft, 61-120 MOD, Hard, 121-180 Hard, 180 + Very Hard						
Licking River	75/01/02	75/12/04	68	140	35	9	34.4
Salyersville	70/07/29	74/11/19	72	200	32	44	34.9
	65/05/19	74/11/-	140	140	32	57	110
N. Fork Licking River LE	70/09/23	72/08/15	140.0	160.0	120.0	3	20.0

Table I-7
Continued

Station	Beg. Date	End Date	Mean	Max.	Min	OBS.	S
Licking River	70/01/03	73/09/25	103.1	170.0	42.0	94	32.1
McKinneysburg	65/01/13	73/09/25	106.3	171.0	42.0	213	31.8
	59/10/07	73/09/25	102.9	171.0	39.0	341	29.0
Licking River	75/01/08	75/10/09	107.2	140.0	85.0	10	16.3
Butler	74/10/17	74/12/10	130.0	150.0	110.0	3	20.0
Licking River	62/09/24	72/08/15	120.0	130.0	104.0	4	12.7
Catawba							
STORET #00915	Calcium mg/l, No Standard						
Licking River	75/01/02	75/12/04	17.4	42.0	8.2	9	10.9
Salyersville	70/07/29	74/11/19	18.9	56.0	7.4	44	10.2
Licking River	70/10/17	72/10/31	38.0	51.0	30.0	3	11.4
McKinneysburg	68/11/01	72/10/31	38.0	51.0	30.0	5	8.2
	59/11/03	72/10/31	31.4	55.0	16.0	23	9.3
Licking River	75/01/08	75/10/09	34.1	44.0	26.0	10	5.0
Butler	74/10/17	74/12/10	40.7	48.0	33.0	3	7.5
STORET #00925	Magnesium mg/l, No Standard						
Licking River	72/01/02	75/12/04	5.9	8.6	6.1	3	1.9
Salyersville	68/11/01	72/10/31	6.1	14.0	1.9	44	2.5
Licking River	70/10/17	72/10/31	7.0	7.6	6.1	3	.794
McKinneysburg	68/11/01	72/10/31	7.6	9.5	6.1	5	1.2
	59/11/03	72/10/31	5.7	9.5	2.7	23	1.6
Licking River	75/01/08	75/10/09	5.6	7.3	3.8	10	1.2
Butler	74/10/17	74/12/10	6.5	7.3	5.6	3	.862
STORET #00618	Nitrate mg/l Proposed E.P.A. Std. 10 mg/l						
Licking River	75/01/02	76/01/17	.27	.47	.06	9	.11
Salyersville	71/10/14	74/11/19	.31	.63	.06	31	.15
N. Fork Licking River LE	72/08/15	72/08/15	0.8			1	

Table I-7
Continued

Station	Beg. Date	End Date	Mean	Max.	Min.	OBS	S
Licking River	71/10/05	73/09/25	0.72	1.5	0.01	49	.30
McKinneysburg	71/10/05	73/09/25	0.72	1.5	0.01	49	.30
Licking River Catawba	72/08/15	72/08/15	1.3			1	
STORET #01000	Arsenic ug/l, Kentucky Std. 50 ug/l						
Licking River	75/01/02	75/03/24	0.0	0.0	0.0	3	0.0
Salyersville	74/04/01	74/11/19	2.5	8.0	0.0	4	3.7
	74/04/01	75/03/24	1.4	8.0	0.0	7	2.9
N. Fork Licking River LE	75/07/10	75/12/16	0.75	1.0	0.0	4	0.5
Licking River	65/01/02	65/09/30	0.0	0.0	0.0	9	0.0
McKinneysburg	63/10/29	65/09/30	0.0	0.0	0.0	23	0.0
Licking River Butler	75/01/08	75/10/09	0.0	0.0	0.0	4	0.0
Licking River	75/06/25	75/06/25	1.0			1	
Catawba	74/03/14	74/12/10	1.2	3.0	0.0	6	1.3
STORET #00950	Fluoride micrograms/liter, Kentucky Std. 1.0 ug/l						
Licking River	75/01/02	75/12/04	0.16	0.3	0.0	9	0.10
Salyersville	70/07/29	74/11/19	0.15	0.6	0.0	43	.11
N. Fork Licking River LE	70/09/23	72/08/15	0.2	0.3	0.1	3	0.1
Licking River	70/09/23	72/10/31	0.17	0.3	0.1	7	.08
McKinneysburg	68/11/01	72/10/31	0.17	0.3	0.1	9	.07
	59/11/03	72/10/31	0.18	0.4	0.1	22	.09
Licking River	75/01/08	75/10/09	0.19	0.3	0.0	10	0.1
Butler	74/10/17	74/12/10	0.23	0.4	0.1	3	.15
Licking River	70/09/23	72/08/15	0.23	0.3	0.1	3	.12
Catawba	62/09/24	72/08/15	0.2	0.3	0.1	4	0.1
STORET #01025	Cadmium micrograms/liter, Kentucky Std. 100 ug/l						
Licking River	75/01/02	75/03/24	0.33	1.0	0.0	3	.58
Salyersville	74/04/01	74/11/19	5.8	18.0	1.0	4	8.2

Table I-7
Continued

Station	Beg. Date	End Date	Mean	Max.	Min.	OBS	S
N. Fork Licking River LE	75/07/10	75/12/16	1.3	2.0	1.0	4	0.5
Licking River McKinneysburg	65/01/02 63/10/29	65/09/30 65/09/30	0.0 0.0	0.0 0.0	0.0 0.0	9 23	0.0 0.0
Licking River Butler	75/01/08 74/10/17	75/10/09 74/10/17	.75 1.0	2.0	0.0	4 1	.96
Licking River Catawba	75/01/25 74/03/14	75/06/25 74/12/10	2.0 1.5	4.0	0.0	1 6	1.5
Bacteriological Data	Total Coliform Kentucky Standard 1000/100 ml						
STORET #31503	Total Coliform Colonies per 100 ml						
STORET #31616	Fecal Coliform Colonies per 100 ml						
Licking River Falmouth							
Total Coliform	75/01/06	75/12/10	7575	62600	250	19	
Fecal Coliform	75/05/07	75/12/18	1296	3700	137	8	
Licking River Paris							
Total Coliform	75/01/21	75/12/23	470	1600	69	11	
	75/04/15	75/12/23	688	6800	29	22	
Licking River Cynthiana							
Total Coliform	75/01/06	75/12/18	3307	20800	50	18	
Fecal Coliform	75/03/24	75/12/18	1249	8100	4	9	
Licking River Kenton Co.							
Total Coliform	75/01/06	75/12/18	2240	14800	3	18	
Fecal Coliform	75/03/25	75/12/18	574	2100	84	8	